ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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A Bichromate Soda Battery.

M. Hospitalier has described in glowing terms the favorable results obtained from a bichromate soda battery as a source of light. His figures prove that the cost is six times that of Paris gas (6s. 8d.), and that for ten lamps there would be every month 7½ cwt. of sulphuric acid, 2½ cwt. of zinc and 2½ cwt. of bichromate of soda to be dealt with. This, our contemporary thinks, would convert each unfortunate private residence into a chemical factory.

From a Discriminating Editor in Texas.

The Fort Worth, Texas, *Sunday Mirror*, displays its wisdom in the following editorial remark:

"The ELECTRICAL REVIEW of New York is the foremost electrical journal in the United States, and is the recognized authority on all questions pertaining to electricity. C. C. Haskins and George Hamilton, the consulting electricians, have been recognized from the earliest days of telegraphy as brainy men and fine electricians, and stand at the head of the profession. In addition to the other valuable features of this splendid weekly, it contains a column of questions and answers, in which the most difficult electrical problems are cheerfully and correctly answered."

New Work of the American Company.

In the illustrations presented on the three following pages, the latest work of the American Electric Manufacturing Company is to be seen. The new American dynamo constructed under the Wood patents is well known to the electric lighting public. In the current regulator, the American Company again offers the invention of Electrician J. J. Wood as furnishing an automatic regulator at once simple and reliable, always effective in operation. The regulator, it is claimed, is so correct in its action that from one light to fifty on a 50-light machine may be turned off at once without endangering the dynamo. As the number of lights are lessened or increased the brushes are automatically shifted from the maximum to the minimum point, with a corresponding increase or diminution of power as the lamps are turned on or off.

A number of valuable improvements are claimed by the American Company in their new street lamp, shown on page 3. It is built so as to hold either the single or the double lamps. The hood shields it from the elements in bad weather and also serves as a reflector to throw the light downward. In the top of the hood is placed a hanger board of entirely new design. By it the lamp is suspended and protected from damage should it be swung by the action of a storm or other causes. It also furnishes a perfect safeguard from accident should the operator or cleaner be obliged to handle the lamp while the current is flowing. It has reliable spring contacts and an absolute cut-out.

The American cut-out box, switchboard and ammeter are also shown, and under the skillful hand of Mr. Wood have all reached a state of art that goes to make up the complete system of the American Company.

Mr. Edwards H. Goff, President of the American Company, is justly elated over his success in securing complete control of the Fuller-Wood electric lighting system, and will now be able to devote his great energy and ability to forwarding the interests of the American system unhampered. We are informed that the Western business of this company is greatly increased.

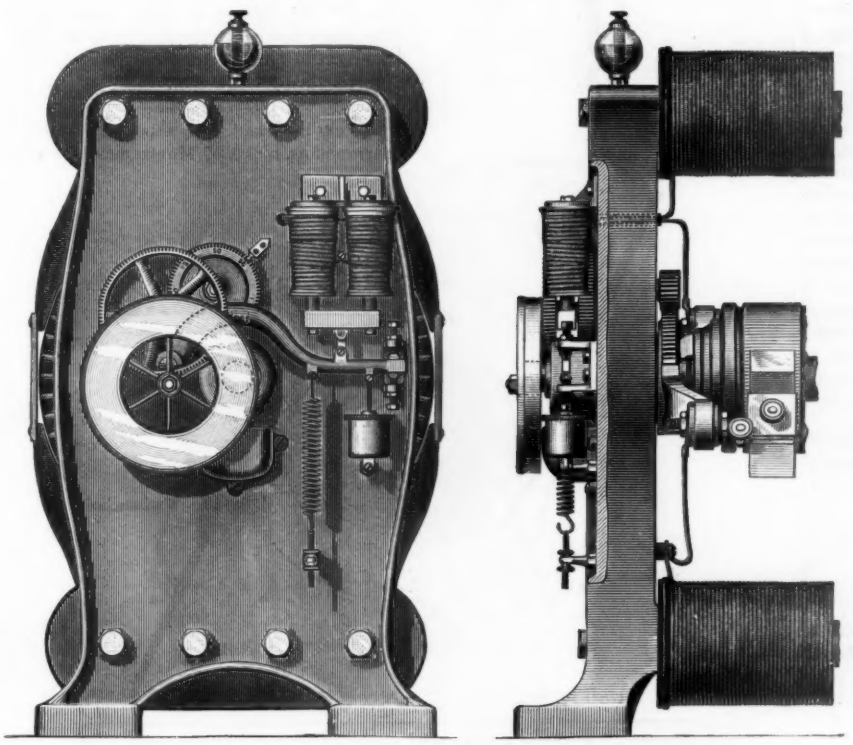


FIG. 2.—WOOD AUTOMATIC REGULATOR.

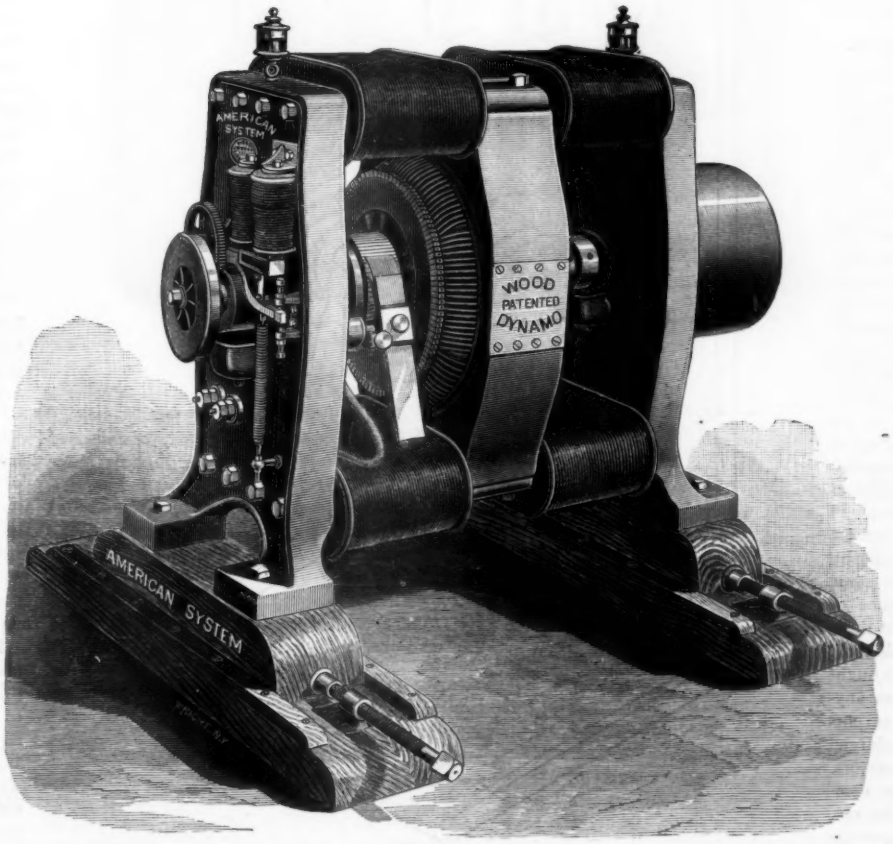


FIG. 1.—THE AMERICAN DYNAMO.

Some Points on Commutators.

The manufacture of commutators containing many sections has been a matter of some difficulty. Solid castings have been turned up and sawed or cut on the milling machine into the desired number of sections. This answers well for small machines of a small number of sections, but in commutators of 150 or more sections the insulation would take up more space than the copper strips. Copper bars have been rolled of the desired tapering section, and the vertical arm attached by solder. A better method is the use of copper castings. In this case the density of each must be carefully estimated in order that pieces with blow holes may be discarded. An ingenious method of manufacture was seen by the writer at the works of Billings & Spence, Hartford, Conn. A rod of copper, ⅝ inch diameter, about 9 inches long was heated in a furnace to redness. The pressman seized it with a pair of tongs and placed one end on the edge of the anvil. Two blows and the end was squared. The middle of the rod was next placed on the anvil, and inch by inch the whole rod was flattened. It was now placed over a V shaped die and one blow bent it at right angles. It looked somewhat like a commutator section, and after a few blows upon it in a cast-iron die the shape was true. A cutter die at one blow removed the superfluous metal that had been squeezed out of the form, and after a few hammerings in an accurate steel die the section was finished, requiring only trimming on the ends before assembling in a commutator.

Determination of the Coefficient of Self-Induction.

By P. H. Lederer.

The method employed is that of the Wheatstone bridge, the coil or electro-magnet being in one branch. The resistance of the coil is first balanced in the ordinary way. The opening and closing of the battery circuit then give rise to induced currents depending on the electro-magnetic capacity of the coil; and from the deflection of the galvanometer the coefficient of self-induction can be determined.

From the application of Kirchoff's laws to the currents and resistances in the bridge, four equations are obtained, which, when simplified, reduce to the general formula

$$\int i_0\,dt = \frac{L\,l'\,I}{l\,(R'+l')+g\,(l+l')}$$

where L is the coefficient of self-induction of the coil, I the current in it, l, l', R' the resistances of the three arms of the bridge, g that of the galvanometer, and i_0 the current in the galvanometer circuit.

To determine L from the above equation, we must know not only the resistances above mentioned, but also the quantity of electricity, $\int i_0\,dt$, which passes through the galvanometer. This may be arrived at by comparing the throw of the galvanometer needle due to the induced current with the deflection occasioned by the permanent current which passes when the balance of the bridge is upset by the addition of a small resistance, r, to one arm, for we have finally, supposing I has not been altered by introducing r,

$$\int \frac{i_0\,.\,dt}{i'_0} = \frac{L}{r}$$

To compare the throw, δ, produced by the quantity of electricity under the integral with the deflection, a, produced by the current, i'_0 we have

$$\int \frac{i_0}{i'_0}\,dt = \frac{\delta}{a} \times \frac{T}{\sqrt{\pi^2+\lambda^2}} \times \varepsilon^{\frac{\lambda}{\pi}\tan.^{-1}\frac{\pi}{\lambda}}$$

where γ is the logarithmic decrement, the right-hand side of which equation for a ballistic undamped galvanometer becomes simply

$$= \frac{\delta}{a} \times \frac{T}{\pi}$$

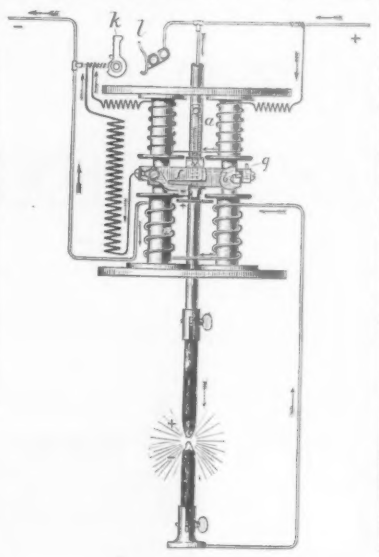
so that we obtain

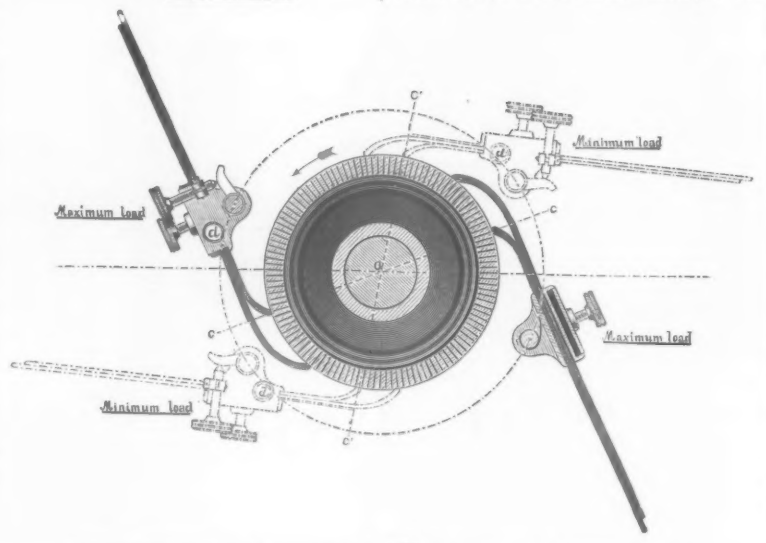
$$L = r\frac{T}{\pi} \cdot \frac{\delta}{a},$$

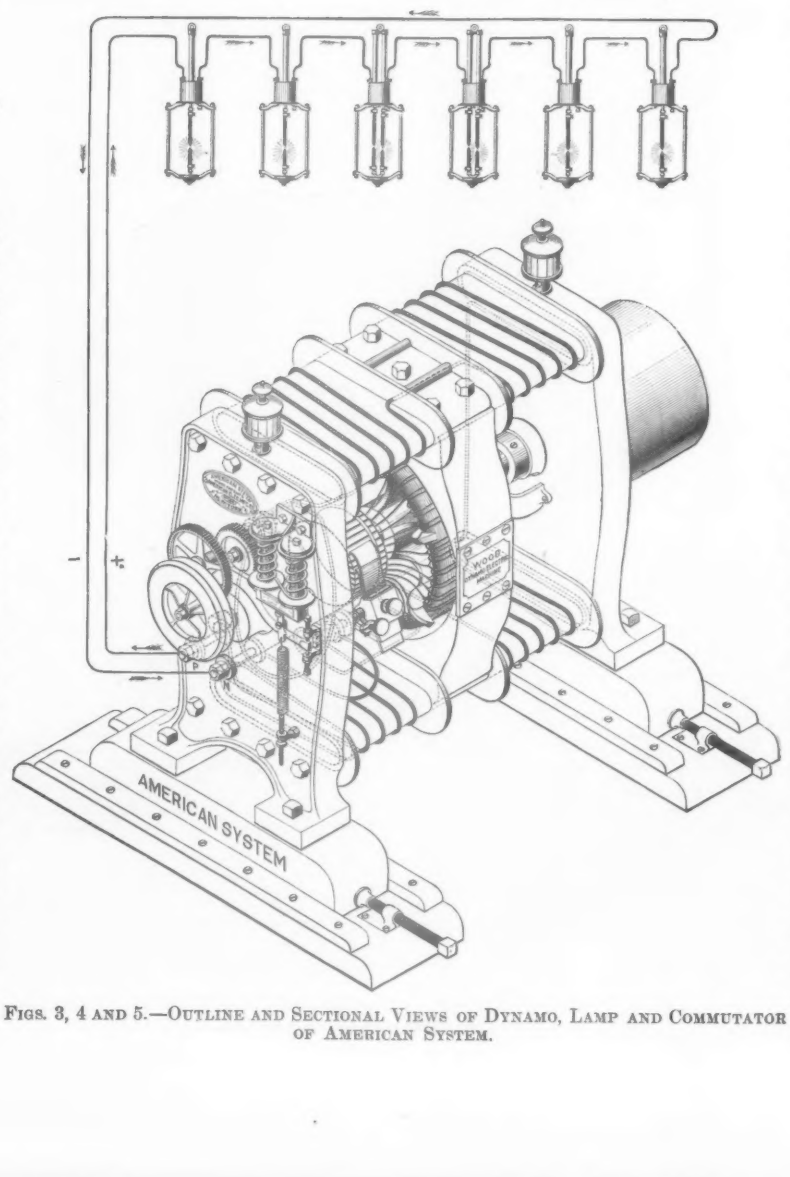
where T is the time of one oscillation, which can be readily determined.

Joint Gas and Electric Light Supply.

The corporate titles of the Marblehead and Dedham and Hyde Park (Mass.) Gas companies have been amended by the addition of the words, "electric light," so that they now read, "Gas and Electric Light Companies." It will be remembered that Mr. W. Eliot Fette, who is largely interested in the above named enterprises, received legislative sanction for such increase in their corporate scope from the last assemblage of the Massachusetts lawmakers. Stock certificate books worded to meet the new conditions, are now being prepared, and when these are ready the old shares are to be called in and replaced by the new ones. In his note to us Mr. Fette says: "We as yet (Nov. 23) are doing no electric lighting at Marblehead or Dedham, but have advertised to do so when we have secured a sufficient number of applications for the lights. In this way we occupy the ground as against outsiders who have no special authority from the Legislature, and can, with some chance of success, oppose the entrance of others until the towns have proved that there is room for two electric light companies. If there is any money in the business we ought surely to be as well able to make it as anybody—we have surplus steam and surplus fuel—and certainly the possession of enlarged powers is no detriment to their possessors. It is gratifying to me to see so many companies following the path indicated by me. I presume the final result will be the passage of a general law by the State of Massachusetts permitting gas companies to supply electric light." The manager of the South Boston Gas Company (Mr. Fette has been one of its board of directors since 1875) will apply to the Legislature for powers similar to those above noted, and it is also understood that Brookline, Chelsea, Clinto, Roxbury will follow suit. There can be no gainsaying the fact that New England's gas managers are inclined to favor the conjoint operation of gas and electric plants; and it is equally certain that the inclination to do so constantly becomes stronger.—*Am. Gas Light Journal.*







Figs. 3, 4 and 5.—Outline and Sectional Views of Dynamo, Lamp and Commutator of American System.

In view of the strong opposition manifested towards granting permission to gas companies to operate electric light plants, a Review reporter was given by Mr. Fette (who is largely interested in the Marblehead and Dedham and Hyde Park Gas Companies) his view of the situation. Said Mr. Fette: "When we received the right to operate electric light plants in Marblehead and Dedham we were approached by representatives of various electric light companies who were told to canvass the towns for business, and they made a report that there was not enough business to warrant the installation of a plant. When the demand for electric lights, either arc or incandescent, is sufficient to pay, we are ready to put in plants and supply them." Mr. Fette was much displeased at the report that gas companies were obtaining the right to furnish electric lights merely to prevent their introduction.

To cut hardened steel, especially forming narrow slots, a disk of Muntz metal, or soft brass revolving at about the speed used for turning wrought iron of the size of the disk, and using fine quartz sand or emery, has been found to work better than disks of other material.

The "Union" Storage Cell.

Under the above name, says *Electrician*, London, the "Union" Electrical Power and Light Company are introducing a new type of secondary battery. The positive electrode consists of a solid slab of peroxide of lead, which is so prepared as to assume a highly coherent form, and which, moreover, is an excellent conductor of electricity. At the same time the slab has a sufficiently porous texture to present a very large effective surface. Contact is made with the electrode by means of a slip of platinum foil, over which is laid a thin strip of celluloid, the whole being secured to the surface of the peroxide by means of two bolts of insulating material. Owing to the conducting power of the peroxide and its solid condition, no lead supporting plate is necessary, and hence there is no tendency to buckle or to short circuit. The positive element consists of a slab of spongy lead. In order still further to increase the output for a given dead weight, internal cells made of celluloid are employed, which are placed in plain wooden boxes. The result, according to the statement of the company, is a capacity of 5 ampere hours per pound of total weight. This is a very marked advance, and should render the battery well suited for use with miners' safety lamps, as well as for heavier work, where a portable battery is required, such as for tramcar and torpedo boat service. A further advantage obtainable by the use of this particular type of cathode is that both plates may be removed from the cell, and may readily be transported to any required distance for recharging. The company therefore proposes to supply batteries for electric lighting upon the system of removal for re-charging. It is, moreover, pointed out that as the peroxide plates may be stored in the dry state, a third set of plates ready charged may be kept always at hand, so that in the event of any abnormal discharge the installation will not be dependent upon the punctual removal of the plates.

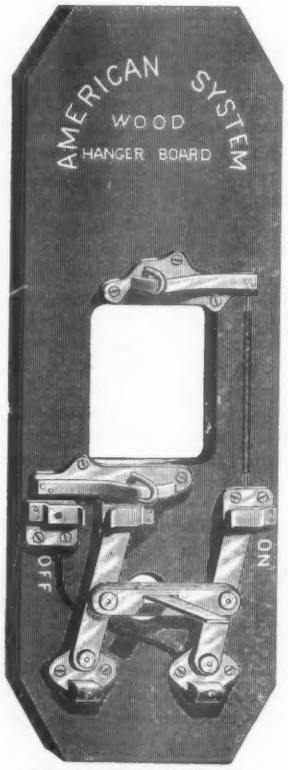


Fig. 6.—Hanger Board.

It strikes us that an electrode made as above described would very soon become practically useless, by reason of the increase of resistance in the cell, due to formation of sulphate of lead in and through the mass of peroxide of which the electrode is formed. Terminals of platinum sufficiently large to carry a practical charging current would, we fancy, be somewhat expensive. Electrodes formed of a compressed oxide of lead have been patented in this country by Starr and Tribe.

Electrical Lighting at Asbury Park.

To the Editor of Electrical Review:

Allow me to correct a statement made by your Philadelphia correspondent, in last week's issue of the REVIEW. He states that we have 45 Thomson-Houston lamps and 30 half-arc American. It should read 50 American and 45 half-arc Thomson-Houston. The Thomson-Houston are run only during the summer months; the American are run the entire year. And, by the way, Asbury Park claims to be the only seaside resort along the Atlantic coast running electric lights the entire year.

We have just closed contracts for two 50-light American dynamos, one 100 horse power New York safety steam power engine and two 65 horse power boilers, all of which will be in position the present month. Our capacity will then be 45 Thomson-Houston lamps, 125 American lamps and 200 incandescent lamps, run on Sun converters, from an American dynamo.

Yours respectfully,

GEO. M. LANE, Supt.

Asbury Park, April 14.

Notes from Boston.

That the West End Railroad Company are to obtain the right to tunnel Beacon is generally admitted, and that horse or cable power to operate the cars is not desirable for many reasons, to say nothing of the economy of an electric system. The West End Company is expected by some to absorb the entire city: the stock has increased in value 900 per cent., and there is a strong speculative feeling in the entered list of railway and land stocks. The avowed intention of the company is to employ electricity as the motive force, and experiments are in progress and will be continued with storage batteries for motive power and light. The use of an underground conduit is not looked on at present with much favor, and over-head wires in a large city are out of the question.

"Ruddygore" is drawing large audiences at the Globe theater. For some time incandescent lights have been used in the offices and entrances, and recently gas has been displaced in the entire house, much to the comfort and enjoyment of the audiences.

The air is purer and less oppressive, and the trembling of everything behind the footlights is wanting. It is now easy to hear from any part of the house, where previously only the clearest articulation could be understood. The density of the wall of hot air from gas footlights impedes the propagation of the sound waves. Just before and after the "March of the Ancestors" the house is for a moment entirely darkened, and the musical director wields a baton on the end of which is placed a small incandescent lamp with red globe.

The town of Spencer, Mass., has few rivals in enterprise. The gas company recently established there are supplying gas at $1.25 per 1,000 cubic feet, largely for heat and cooking. The president of the company, Luther Hill, has his entire house with gas. The plant includes engine and boilers, which will be utilized in operating for the purpose of illuminating the streets, a 30 arc light plant furnished by "The" Ball Electric Light Company of New England.

Mr. Frank Ridlon, of the Boston Highlands, where he has recently built a most pleasant and comfortable home, is one of the active representatives of electic lighting interests, whose statements have never been subject for dispute. While always loyal to the Brush-Swan Company, other systems are fairly treated in all competitions that may arise. No man in the business has more or warmer friends, and no one can point to a better record in point of important electric lighting contracts.

The mayor has vetoed the order passed by the Board of Aldermen giving the Hot Water High Pressure Heat and Power Distributing Company a location in the city. For heating purposes the system is undoubtedly a success, but in the distribution of power it is questionable if it can compete with electric power. Our streets are now used for every kind of business, and to complete the list it only needs the claim of some one for the use of a portion of the streets in which to raise garden truck.

A. B.

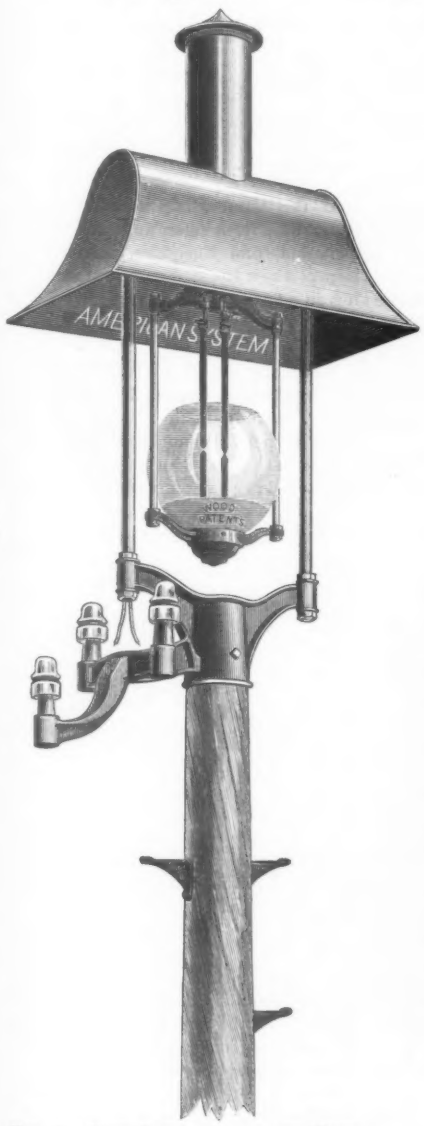


FIG. 7.—NEW STREET LAMP AND POST

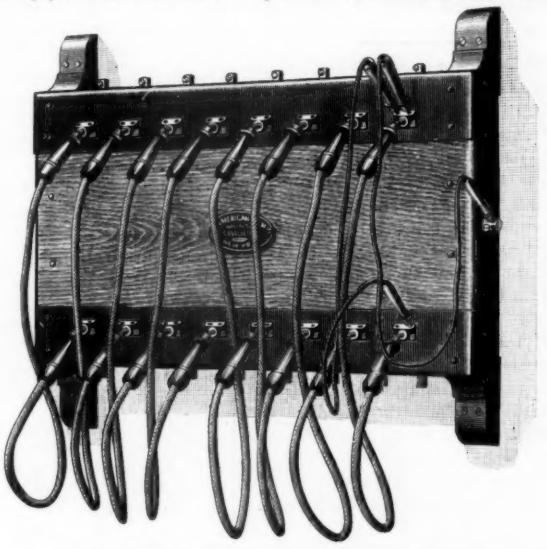


FIG. 8.—SWITCH-BOARD AND LIGHTNING ARESTER.

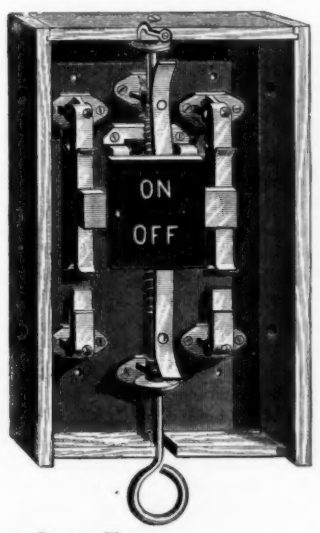


FIG. 9.—CUT-OUT BOX—OUTSIDE AND INSIDE VIEWS.

A would-be electrical engineer was one day examining a very successful rack and pinion arc lamp, and after several trials succeeded in letting the solenoid drop without the lamp feeding, the pendulum movement not being set in motion. In high glee he called the attention of the electrician in charge to the fact, who quietly replied: "Of course it can't feed, the carbons are together." The debutant E. E. bethought himself of a pressing engagement with a friend, and withdrew with a speed rivaled only by that of the electric current itself.

*** The depression in telephone stocks of 1884 was the means of benefiting a number of gentlemen with long heads, who, purchasing the stocks at the low prices, now enjoy a steady business—compelling a rise in value of these properties. It is a long lane that has no turning.

* * These are years of sun spots, of high license, of endless stock schemes. Schneutzer became interested a few days ago in the "Anti-Sleet Destruction Company (unlimited) of the State of N. I. The company he claims has Ragnarocks patents, the principle of melting snow and sleet from overhead telegraph and telephone wires by heating them with a heavy current of electricity, a constant current dynamo being employed. It is desirable to couple up the wires in complete metallic circuit. There is need of applying the heavy dynamo current only at intervals, or as often as a considerable quantity of sleet collects on the wires. The capital of the company is said to be $5.00 paid up.

Home Electricity.

Winter is the time for showing how to light the gas with one's finger. Many have failed because of the lava tipped burner. Take a hair pin and twist this round the metal part of the burner tight enough so it will stay. Now bend one end so as to bring it over the opening of the burner. Let the young lady or gentleman who is to play lamp-lighter slide or scuffle across an ordinary parlor floor or dance eight bars on a fur rug. Then let a second person turn on the gas, and when

FIG. 10.—THE AMMETER OF THE AMERICAN CO.

the charged person brings a finger within half an inch or less of that hair-pin, the spark passes through the flowing gas and sets it ablaze.

Put a little Miss on a checker-board that rests upon four glass goblets and whip her gently with her cat-skin muff. Her hair will show that she is filled with static electricity, and a spark may be drawn from her nose.

The close relationship between magnetism and electricity may be shown by rubbing the glass that covers a compass needle with a silk handkerchief. Or, is it only the electrical attraction? Some of you younger electrical students may answer this.

Rub an india-rubber—erroneously called gutta-percha—match box or comb on your woolen coat, and see how it will pick up little bits of paper. Sealing wax will do the same, but if you rub that too hard it will melt and soil your coat.

Lay a sheet of paper on a varnished table and rub it with a rubber eraser. See how affectionate it becomes. Put two sheets down, one on the other, and note how they will stick together when rubbed, even with your hand, if it is a good day for such experiments.

Take a little bit of newspaper, about half an inch square, and sew a thread through it. Now run a rubber comb through your hair half a dozen times, and bring it near the paper which is suspended from your other hand. If it touches it never so lightly, see how it keeps away afterward. Try the other end of the comb, and see what effect that will have. Why does it do this?

When you have charged the bit of paper by allowing it to touch the comb, perhaps you can cause it to stick by one edge to the looking-glass or a piece of furniture. If you succeed in doing this, you can make the little paper swing back and forth like a gate by passing the comb near it. If you can't do these things at once, try again, little folks. Don't give up.

The colder and drier the weather the better these experiments will succeed.

All Electric Lighting Bids Thrown Out.

All the bids for lighting the city of New York with electric lights were thrown out by the Gas Commission at its meeting last week, and the proposals are to be readvertised, the new bids to be opened on April 26. The contracts for lighting the annexed district were awarded to the Northern, the Yonkers, the New York and New Jersey and the Globe Gas Companies.

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There is an increase just now in the number of experiments with new carbons. The inventor, with the 14-hour carbon, is abroad in the land, but tests have, so far, failed to prove his claims.

Successful experiments with a navigable balloon are reported from Metz, in which electricity is the propelling power. The speed of the balloon exceeds that of a railway train, is said to be under perfect control, and has been purchased by the German Government for 1,000,000 marks down and an equal sum to be paid in installments. The balloon is the invention of a German engineer named Welker, who is said to have perfected his discovery in America, where he was at one time employed.

The inventor of the vacuum balloon should lose no time in perfecting his flying machine, or Germany will take the lead.

This promises to be a great electrical year, not only in point of demand, but in new inventions. The activity in storage batteries, in converters and in improving electrical machinery generally was never greater.

Electricity has done wonders, and in addition gets credit for many things it does not do; but, if the Associated Press dispatches from Berlin are true, it has been the means of solving that great problem, aerial navigation. All credit to electricity.

On and after April 30th Indiana towns of less than 10,000 inhabitants will be deprived of telephonic exchanges. All contracts will be canceled. The company claims it cannot maintain such exchanges at the legal rate of $3.00 per month. Substitutes in the way of private lines will be arranged for when desired, the charges for these being specially regulated in each case according to groupings of the different kinds of service rendered.

There is perhaps no one item of household expense more reluctantly paid for than that for light. This is in some degree due to a want of enterprise and care on the part of gas light companies. A reduction of the price of gas, followed by increased pressure on the mains, the uneven admixture of non-luminous water gas causing the flame to be at one time smoky, at another nearly invisible, the slight interest shown by gas men in improved methods for lighting and extinguishing gas, have combined to make chronic growlers. Incandescent lighting ought not to be compared with gas in cost; it should be put forward as immeasurably superior; and the fashion to have the best is strong. One would as soon think of using stove-polish for shoe-blacking, or pewter for silver ware, or oleo in place of butter, or hemlock for mahogany, as a confessedly poisonous, begriming, flickering form of illumination in place of something better, if time be allowed for education. The incandescent light is steady, pleasant, harmless, and is fast becoming fashionable.

A dance that has been enjoyed peculiarly by the unsophisticated for the past century has lately been reduced to a science, and duly listed. The next assemby will be announced when a new battery in New York city becomes polarized. One inspecting the system is led to infer that the various incandescent lamps in the room are supplied with current from eight one-gallon jars in plain sight. Batteries are not for sale; but State rights to form sub-companies are for sale, and the light is to be supplied by contract to consumers, the company providing two batteries for each installation, with automatic switch; and one is taken out of the circuit when discharged, the fresh one replacing it. An employe every week cleans the cells, the zinc solution alone requiring replenishing. The semi-solid depolarizing solution in outer cup is said to be self-reviving and everlasting. It is doubtful if there will be enough current six months hence to galvanize the courage of the stockholders. The claim is made that incandescent lighting is much cheaper by this system than gas. The battery uses zinc; and, making no mention of the cost of the self-restoring solution, it is pretty well established that at the present and probable future cost of zinc, incandescent lighting from primary batteries can never be cheaper than gas.

Although somewhat early to predict, there is strong indications that the semi-annual meeting of the National Electric Light Association at Boston, the latter part of next August, will be largely attended. These meetings have continually grown in value and interest, and are occasions of genuine profit to every attendant. Mr. F. A. Gilbert, chairman of the Executive Committee, is a resident of Boston, and will see that all necessary arrangements for a pleasant and instructive meeting are made.

AN OLD FABLE WITH MODERN IMPROVEMENTS.

The other evening while standing among a group of his friends in the vestibulum of Xanthus, Æsop thoughtfully glanced up at the brilliantly illuminated electrolier over his head and delivered himself of the following fable:

A respectable looking fox, being disinclined to earn an honest living, and having arrived nearly at the point of starvation because of his inability to deceive the other animals in the usual ways peculiar to foxes, bethought him of an old trick which he remembered hearing his grandfather describe, that worthy having got a living out of it himself.

Knowing very well that the other animals liked to be deceived, and remembering how soon they forget a deception of the most glaring kind, this fox got up a company, hired an office pretty well down towards the Battery, and issued circulars to the effect that he had a system for producing electric light from primary batteries, which possessed many wonderfully good features, and the stock in his company offered a rare opportunity for conservative investment. Among other things, this fox claimed in print that his system was "cheaper than any other means of producing electric power," and the only requirements for operating one of his plants was 'ordinary care and occasional watchfulness."

Of course this wonderful announcement brought to his office many of the animals, and it was indeed amusing to watch them and listen to their conversation.

First of all came other foxes, who looked child like and bland, said little, and watched him manipulate his wires and light up his pretty little lamps for a few moments while he waxed eloquent in their praise. These thanked him and went away with the inward remark that they guessed there was nothing for them there.

Then came an owl or two who introduced themselves as "electricians," did most of the talking, delivered windy lectures on the future possibilities of the electric light, and how they always knew that some day a primary battery would solve the electric light question, and gave the hungry fox much professional advice, for which they made no charge; but these also went away without buying any stock or even showing a proper amount of enthusiasm in regard to purchasing a State right.

Also some of the larger animals who were engaged in the serious business of commercial electric lighting, and were operating plants of their own, hearing of the thing, joked about it among themselves, and with a laugh at its absurdity forgot the whole matter.

It also came to the notice of one or two beavers, who had spent all their lives in gnawing at electrical matters, and in the course of time had digested some of them, and they gave just one glance at his circular, and pronounced him to be an unqualified fraud.

At this the poor fox was about to give up, when a flock of lambs began to nibble at the fresh leaves of his circulars, and, being pleased with the taste, at once went to see him and his wonderful invention. They saw it all, and knowing absolutely nothing of the subject in hand, but feeling sure they were pretty smart, bought stock and State rights to his heart's content, and allowed the fox to shear them of their beautiful fleeces and send them out into the cold March weather, which he did with the profound hope that they might catch their death of cold before they discovered how badly he had swindled them. And still they came to be sheared, and are still coming, and the fox is growing sleek and fat.

Not long ago, however, a wise old ram, getting wind of the matter, and being as willing as the next one to turn a dollar, if it could be done honestly and safely, and feeling that he was entirely unqualified to judge of the matter, went and hunted up Grimalkin, the cat, who had had some experience in such matters, and employed him to look into the matter.

Now Grimalkin, knowing that responsible parties had commercially furnished light from primary batteries at prices which the wealthy could afford as a luxury, thought that perhaps after all the fox might have struck something valuable. So he disguised himself as the animal known as *Theabsolutefool* and called upon the fox at his office, and a most amusing call it was—at least for *Theabsolutefool*. The fox told all he knew, and perhaps a little more, and enthused over the wisdom of the lambs who had bought stock and State rights and had so much enjoyed carrying this system to the south and west. He turned off and on his little lights one at a time and assured his visitor that light could be furnished to customers at a price that would compare favorably with city gas; he also intimated that in the near future they contemplated furnishing central station lighting from large batteries.

However, Grimalkin convinced himself that although it looks very pretty and will surely mislead the unwary, the whole thing is without the slightest foundation of truth or honesty, and is entirely unable to meet the requirements of electric light service, and that it would be foolish to attempt to light a house by this system, or rather want of system, and *Theabsolutefool* went out and advised his friends that they might as well throw their money into the East river as invest it in the stock or State rights offered for sale by the fox.

At this point Æsop abruptly ended his story, lit a fresh cigar, and with a muttered quotation from Euripides, sauntered out to inspect a new squirted carbon that was burning on a test over the way.

FUSIBLE STRIPS.

While the use of the fusible metal strips in incandescent circuits is a necessity for safety, there is such a thing as making a safety strip a very dangerous affair.

Case 1st. Where an incandescent plant is installed in a paint or varnish manufactory, or in any establishment where the vapors of alcohol, naphtha, turpentine, or other high inflammable vapors may come in contact with the metal. An overcharge of current which would fuse the metal would be quite liable to volatilize it, and explode the gassy vapor with which the air was saturated.

Case 2d. The use of vulcanized rubber for soft metal strip bases may be made dangerous by the oxidation of the rubber. Wood is better. The surface of a piece of weathered hard rubber sometimes becomes a conductor, instead of an insulator, by the oxidation of the sulphur used in vulcanization. These bases, lying next the wall may ground the line at any time. A very reprehensible habit is wrapping such a base, containing a soft metal strip, with tape.

Several such were recently taken out of a plant, where it is but charitable to presume they were placed through ignorance or thoughtlessness. Experimenting with these showed that the melting out of the metal by an excess of current would sometimes set fire to the wrapping of tape.

Now, a suggestion of danger is more likely to be heeded when a preventive or a remedy accompanies the announcement.

In any of the above places where volatile oils, fine dust from sand-papering machinery, flour, or the like fills the atmosphere, the safety strip, fusible plug, or what not, to be safe, should be put outside such room, and if there is no safe room in the building, put it outside of the house, in a properly arranged box.

A handful of wheat flour, agitated in a box or barrel, so as to thoroughly mix it with the atmosphere, will take fire as readily as gunpowder, and astonish the novice with the report; and a spark of electricity will fire the mixture.

The Telephone Exchange at Atlanta, Ga., has purchased a two horse power engine and will put in a generator at once to replace the batteries now in use. This exchange keeps abreast with all improvements and continues to grow rapidly as to give unbounded satisfaction to its patrons.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

If the electric lighting interests of the city of Chicago are not consolidated and crystallized, it certainly will not be because there is a lack of the consolidating and crystallizing elements to be had.

For months there have been rumors, told with bated breath, under the ban of secresy, that something wonderful was on foot in the way of gobbling up existing central plants, running these under one colossal management eventually forming a combination which would set the entire city-in-a-garden ablaze with electric lights everywhere, and ruthlessly crush out anyone who should have the audacity to offer even a suggestion of running an electric light plant here.

Rumors have specified, as on the anxious seat:

1. A newly organized company which is managed and controlled by a well-known combination of capitalists and engineers, which has intimated its desire to control electric lighting here, and the underground business in connection with it.

2. A combination in which the management of the Chicago Telephone Company is mentioned as an important factor.

3. An electrical company running a large manufacturing establishment of world-wide fame, desirous of introducing its wares.

4. An electric lighting company which at present is running several miles of line and a large number of lamps, successfully, both electrically and financially.

5. An incandescent company which has recently obtained valuable franchises from the city, is mentioned as getting into the field with "just oodles" of money, and intends going, wholesale and retail, into the arc, as well as incandescent illumination, to the utter extinction and blotting out of any and everybody now in the business. This combination includes representatives "electrical, hotelical, political and businessical," s a slangy old Chicagoan expressed it the other day.

Now, as if that were not enough, in all conscience, the gas syndicates are about to be precipitated upon us, and that these dread fiends, whom the electric light people have been fighting so hard, so faithfully, and at such great disadvantage, are to finally step in and pluck the fruit just as the electrical husbandman has stripped up his sleeves and is about to enter the orchard and club the trees, is really too bad.

And what makes it still worse, the pill more like aloes or gall, is the fact that the great head and front of an electric light system should thus lend himself to the enemy for this purpose. It is, it is, too bad. But here is the straw that crushes us, picked out of the stack behind the thresher of one of Chicago's Sunday newspapers:

Mr. Edwards H. Goff, a New York capitalist, and President and General Manager of the American Electric Manufacturing Company of that city, is at the Grand Pacific. Mr. Goff's business here—if he succeeds in it—will be of very special interest to the people of Chicago. It is believed to be no less than the purchase of a controlling interest in all the gas companies of the city, with a view of uniting these companies in one combination, this combination to build electric light works in connection with each gas works, and thereby control and supply all the artificial lighting of the city both by gas and electricity. Mr. Goff is understood to be acting on behalf of a syndicate of New York capitalists who are already very largely interested in two of the Chicago gas companies. The manufacturing company which Mr Goff is the head of owns a controlling interest in a dozen or more large lighting companies in different cities in the East, some of them electric lighting companies and some joint gas and electric light.

In reply to further strokes of the reporter's pump Mr. Goff said:

Unquestionably within a very few years at least all the Chicago gas companies will be united, and will supply electric light as well as gas light. It will not be a monopoly to keep up prices, but a combination to reduce expenses and thereby reduce prices, and while it will pay the projectors a reasonable dividend it will be very beneficial to the city at the same time. A gas company can build a plant and supply electric light over its territory for half the expense that an independent electric lighting company can. The united gas companies of the city could put in electric lighting works in addition to their gas works and furnish the city with electric light for a little over half the price an independent electric lighting company would have to charge. The saving would be chiefly in the running expenses. For instance, if the consumption of gas were doubled, it would not follow that the cost to the company would be doubled; the total cost would be increased but a trifle. The same force of employes practically could do the work. Then again, the introduction of electric lights would increase the consumption of gas. When streets are lighted with electricity there is more gas burned in the houses than was burned altogether when both streets and houses had gas only. This is a demonstrated fact. People accustomed to electric light on the streets must have good light in the house. In Portland, Me., for example, where we put in the plant with which the streets of the city are lighted, the total consumption of gas is greater than when the streets were lighted with gas. In St. Paul it is the same, I believe. Another thing, the introduction of electric lighting is invariably followed by a reduction in the price of gas. If the gas companies in this city supplied electric light also they could light the streets of Chicago with electricity for about half what it now costs the city for gas, and give ten times better light.

Seriously, this straw shows which way the wind blows, and confirms the statement recently made in a leading gas journal editorial on electricity and gas. "As a substantial and legitimate investment [electric lighting] there is now nothing that appeals with more force to capital, when organized upon a proper basis, unless it be the industry of gas manufacture. The combination of the two in one is irresistible."

Our State Legislature is still worrying over the proper way to regulate the telegraph and telephone business to get the greatest amount of money out of it. Baker's bill in the house, which fixes rentals for telephones, was finally reached on the 12th, and after some squabbling, was cast into the lap of the Committee on Judicial Department and Practice. Members are now wrestling with a new form of taxation applicable to the same class of industries, and the end of the measure is doubtful. Many of the Solons seem to think it better to tax these enterprises in the regular way, and not risk the killing of the goose that lays the golden egg.

The Electrical Accumulator Company's storage batteries have been recently placed on sale here. The Western representatives of the business are Johnson, Holland & Co., of Chicago, located at 227 La Salle street. Mr. Johnson, senior member of the firm, has been for some years cashier of the Chicago Telephone Company. Mr. Holland is a practical, energetic worker in electric lighting, while the company is represented by Mr. C. N. Fay, manager of the Chicago Telephone Company. Accumulators, arc and incandescent lights, motors and installations—these are to be the undertakings of the firm, and they have the very best wishes of their numerous electrical friends for success in this new enterprise.

Circumstances are daily transpiring which demand modifications in rules for the guidance of electric light inspections. Now from a scientific and then from an economic point of view. The Chicago inspector was informed a few days ago that a certain plant which had been examined and passed should have been condemned by that officer, because the boiler didn't make steam. A short time since a pair of incandescent OO wires leading from the dynamo into a window on the first floor were used by burglars to enter a residence from which they carried off a lot of valuable plunder. All that saved the Chicago Inspector from possible criticism was the fact that the crackmen's work was done just a little outside the city limits.

Just as soon as there are enough inspectors to give a fair representation outside the officers, Brophy, Barton, McDevitt, and the rest of the electric light "fiends" will probably be compelled to organize a union for self-protection.

CHICAGO, April 18, 1887.

Early Work on Transformers.

(Written for ELECTRICAL REVIEW.)

At the present time, when so much is heard of "transformers," or "converters," or "secondary generators" or, more simply, "induction coils," it may be of some interest to refer briefly to the earlier work in this direction.

The usual induction coil is familiar to us all; that is to say, the coil used for medical purposes, or those of the lecture room. Its most common application has been to the production of currents of comparatively high tension and small quantity in one coil, by induction from a second coil, through which were passed currents of lower tension and greater quantity. This, manifestly, was not its necessary action; for, by passing a high tension, or comparatively high tension current through the wire of numerous turns—the so-called "secondary"—a current of lower potential, but greater quantity, could be obtained in what was therefore the "primary." This was an obvious feature of the apparatus, and many of us have, no doubt, proved it experimentally.

Faraday's experiments in 1830-'31 were the foundation of much of the later work in this line, and so far, indeed, had that great mind anticipated the age, that, had the coil described by Prof. Faraday, in sec. 26 of his "Experimental Researches," come down to the present day, it might be placed in circuit with an alternating current dynamo and made to operate incandescent lamps. In his time, however, there were no incandescent electric lamps, and the germ of a vast improvement was allowed to lie dormant for many years. In 1878 Jim Billings Fuller, of Brooklyn, took up the subject again, and procured a patent in that year. He described an alternating current machine operating a series of primary coils, from which currents of greater or less tension were induced in secondary coils, placed adjacent thereto. At this date the commercial incandescent lamp was only just born; but Fuller stated that he preferred lamps "employing luminous points heated to incandescence, rather than those in which the electric arc is produced." Fuller's further labors in this field were unfortunately cut short by his death, which occurred while he was actually engaged upon this work.

In the meantime Harrison, Bright, Jablochkoff, de Meritens, Edwards, Normandy, and others, had all more or less developed systems of electric distribution by induction.

The most rational and scientific worker on the subject was, so far at least as appears from any published utterances on the matter, Rankin Kennedy, a Scotch professor, and the inventor of an alternating current dynamo which bears his name. He was the first, we believe, to formulate a theory of counter electromotive force, and the method of utilizing that counter electromotive force for the purpose of regulation. This law of counter electromotive force and its application and utilization are derived from Lenz' law—that an induced current tends to oppose the motion or current inducing it. It has been a matter of familiar knowledge for a long time that an electro-magnet placed in an alternating circuit offers a very considerable resistance to the passage of the currents, if "resistance" it may be properly called; at any rate, it has that effect. Now, of course, an induction coil is nothing but an electro-magnet, and the same laws will apply to it. Kennedy found that with seven of his transformers in series, and the secondary circuits open, it was almost impossible to pass a current through the line, although the actual electrical resistance would not amount to more than a few ohms; this result it will be seen being caused by the enormous counter electromotive force set up in the primary coils. How was this to be overcome? Simply by closing the secondary circuit. "The secondary currents," he says, "generated in the secondary wire of such generators in their turn neutralize this counter electromotive force." The secondary generator or transformer employed by Kennedy was one having a closed magnetic circuit, suitably divided for the prevention of Foucault currents, having its primary and secondary circuits of equal mass and in the same relative position with regard to the core—in fact, what he used was a Gramme ring armature. His primary current was 13.86 amperes, his current from the secondary 12.97 amperes, not a very large percentage of loss.

As he says, the sections of the coil may be coupled up in series or parallel to suit the currents required; thus by dividing his secondary coil into two parts and connecting them in multiple arc, he would have double the current but at half the pressure. It is this effect of obtaining, by means of the connections of the secondary, a reduced pressure and an increased quantity, that has given rise to a loose mode of describing the action of an induction system, at any rate as applied to the series system, viz: that of saying the transformer converts high into low tension; the tension or difference of potential between the terminals of the primary and secondary coils respectively of any transformer is precisely the same, after allowing for the loss (say from 2 to 5 per cent.) in conversion. High tension only exists where high resistance exists; for example, at the extreme ends of the line, and not then unless a considerable number of transformers are in series.

But to return: Kennedy pointed out that, if the transformers were placed in multiple arc, the system was a beautifully self-regulating one, and his view has at length, after persistent opposition, been acquiesced in by the most strenuous advocates of the series system. The series system presents so many difficulties in regulation, and involves the employment of such external regulating apparatus, both with respect to the local secondary circuits and the system generally, that the gravest mechanical and practical difficulties present themselves, and it is at this date practically abandoned.

Why the series system is open to this almost fatal objection, and how the multiple arc system turns it to account, space forbids us to enlarge upon at this time. Suffice it to say that it is a most fascinating subject, and that, although probably the last word has not yet been spoken with regard to the distribution of electricity by an induction system, yet the lines of working have been laid down for us, and that while due credit is to be given to those who have already and to those who shall yet devise further improvements in detail in the problem, now nearly solved, of the economical distribution of electricity at long distances, yet let us not forget those who have in the past pointed out the direction in which our efforts should be directed.

J. E. TALPOT.

WOBURN, Mass., April 12.

Queries and Answers.

To the Editor of Electrical Review:

Please inform me in your column entitled Queries and Answers in ELECTRICAL REVIEW, on the questions found below.

a.—How can I make a simple secondary battery or cell, and how can I charge it?

b—Will an induction coil, giving a spark 1½ inches long, kill a small animal, say, for instance, a rat or mouse?

c.—Will common thin white manilla wrapping paper rubbed over with a stick of paraffine do for making a condenser for an induction coil?

L. S. and A. F.

Davenport, Iowa.

ANSWER.—*a.* Take two strips of sheet lead, say 2 inches by 4 inches, and put around them a number of rubber bands to prevent the plates coming in contact when placed together. Place them in a tumbler two-thirds full of water, to which a tablespoonful of sulphuric acid has been added. Arrange two bichromate batteries in series, and connect the poles of this battery one with each of the lead plates. As soon as one lead plate turns brown, and gas is given off from both plates, the battery is charged. Disconnect from the battery and connect with a bell, motor, etc.

b.—Repeated applications of such a current would produce death.

c.—It will answer, provided the texture is close. Bank note paper is superior for this purpose.

Telephonic News

*** As a general thing legislation has disturbed telephone properties but very little the past winter.

*** Topeka, Kansas, is to have its telephone facilities doubled, and a large amount of material has been ordered for the work.

*** It is said to be evident that the bill regulating telephone rentals, before the New York Assembly, will be defeated. It should be.

*** It is thought that the decision of the U. S. Supreme Court in the telephone cases will not be given until next fall. Bell stock is still advancing.

*** Mr. T. W. Lane, formerly with the Western Electric Company, has accepted the position of superintendent of the works of the Utica Fire Alarm Company, of Utica, N. Y.

*** Messrs. Holmes, Booth & Haydens have established an agency in Chicago, with Mr. J. L. Barclay in charge. Their Western wire business has so increased as to demand this additional representation.

*** The Providence, R. I., Telephone Company, has decided to put in the multiple switchboards of the Western Electric Company. The multiple system is so generally adopted that but few large exchanges are left without it.

*** There seems to be a diversity of opinion concerning the working of the writing telegraph instruments in Rochester. Some of the users claim to be greatly pleased, and a fresh lot of instruments are said to have been ordered.

*** A pleasant voice answering from "Central" always convinces the subscribers that the owner is pretty, and we are sure if the young lady operators will remember this they will always give sweet answers. As it is, they nearly always do, though the provocation to do just the opposite must sometimes be very great.

*** It is now probable that the Electrical Subway bill, which continues the present commissions of New York and Brooklyn, and with the addition of the Mayor, Comptroller and Commissioner of Public Works, will be enacted by the Assembly. The work done by the commissions has been quite extensive, and their continuance is, no doubt, the best means to get at all the facts connected with burying the electric wires in New York and Brooklyn.

*** The Central Union Telephone Company is notifying patrons in places of less than 10,000 inhabitants that on April 30 the telephone exchanges operated by the Central will be closed and contracts terminated. This action is taken in view of the fact that the law repealing the $3.00 per month rental was not enacted by the last legislature. The company asserts that it cannot maintain exchanges at this figure. It proposes to give private lines, which will be practically the same service as at present, but it is understood the charges will be grouped under different heads, the price to be regulated by the Central Company.

*** Some of the features of shorthand-writing, synchronous-multiplex telegraphy and type-writing are combined in a system of steno-telegraphy invented by M. G. A. Cassagnes, of Paris. In recent experiments over a wire running from Paris to Orleans and back, messages were sent at the rate of two hundred words a minute, that being the highest speed attainable by a nimble-fingered operator. By means of an automatic transmitting apparatus, using a strip of paper previously perforated, as in some of the systems of telegraphy already in vogue, seventeen thousand words per hour were sent over a line 650 kilometers in length, the messages being automatically printed by the receiving instrument.

The Hess Guest Call.

The interest in proper safety appliances for hotels has greatly increased of late since the number of disastrous fires in hotels have been recorded. We illustrate a new guest call manufactured by the Standard Electrical Works, of Cincinnati, showing different views of the system which is known as the Hess. This system received a crucial test at the Richmond Hotel fire in Buffalo, and proved effective in every particular, undoubtedly saving the lives of the guests. The alarm was turned on as soon as the fire was discovered, and in every room the bells commenced to ring, arousing the inmates to a sense of danger. Ever since the Hess alarm has been in great demand, and the Standard Company is manufacturing to a much larger extent than ever before.

A Telephone Suit Settled.

During the past year a costly litigation has been in progress at Youngstown, Ohio, between the Central Union Telephone Company and the Electric Light Company, it being claimed that the wires of the latter were run so closely to the telephone wires as to interfere with service by reason of induction. Several thousand dollars have been expended in taking depositions and a large amount for counsel fees. The case was settled last week, a decree being entered providing that an electric light wire should not run closer than 150 feet to the telephone wires, and that double electric wires must keep 30 feet away, except where they have to cross the other lines, when the distance shall be 12 feet. Each company is to pay its own costs and counsel fees.

FIG. 2.—SMALL ANNUNCIATOR CASE.

Electric Police Alarm Systems.

Five police alarm systems are being tried in the Twenty-ninth precinct, New York. As yet, only one system has been used. It is a small square box, attached to a lamp-post or telegraph pole on each beat, containing an automatic telegraph instrument, which communicates with the station-house and hospitals. When an ambulance is required, the policeman touches his hospital alarm, and communicates directly with the hospital authorities. The old system required the policeman first to go to or send to the station, whence the sergeant telegraphed to the Central Office.

Another system, which is used very satisfactorily in the city of Chicago, will be tried in a few days. Little booths, just large enough for a policeman, will be erected on the street corners. A booth will contain an electric signal and a telephone. The policeman can stand at his post and communicate with the station by telegraph and telephone. An instrument in the station-house registers his wants on a slip of paper. One of these booths is at Eighteenth street and Seventh avenue now.

There will also be three other systems. The Brewer system, which has not yet been in practical use, will cause a red light to bob up and down around the glass of a street lamp when a policeman on that post is wanted from the station-house. If he is several blocks away this little light will attract his attention. An automatic alarm box is attached to the lamp-post, by which he can communicate with the station.

The system used in New Haven will also be exhibited. It is virtually on the same principle as that used in Chicago, except that no booths are used. It is simply a box, large enough to contain a telephone and telegraph instrument, which can be placed conveniently against a house or on a telegraph pole.

All of the systems will be in working order in a week or two. By any of them the captain of a precinct may, by touching a telegraph key in the station house, summon every policeman on duty in his precinct.

Complete Report of the American Bell Telephone Company.

OFFICE OF THE AM. BELL TEL. CO.,
BOSTON, March 29, 1887.

To the Stockholders:

Our business for the year ending December 31, 1886, was marked by an improvement over the previous year, especially in exchange subscribers, the total number showing an increase of 9,318 as against 2,969 in 1885.

The following comparative statistics will be found of interest:

FIG. 1.—HESS GUEST CALL OF STANDARD ELECTRICAL WORKS, CINCINNATI.

EXCHANGE CONNECTIONS.

The estimated average number of exchange connections daily in the United States is.....	856,454
Or a total per year of.....	312,605,710
The number of daily calls per subscriber varies in different exchanges from 2 to 15, the average throughout the United States being.....	5 82-100
As compared with.....	5 43-100

the number reported last year, an increase of 7 per cent.

The average cost to the subscriber varies, according to the size of the exchange, and character of the service, from 2 to 7 cents per connection.

EXTRA-TERRITORIAL BUSINESS.

The average daily number of extra-territorial connections is	7,402
Or a total per year of.....	2,701,730
The extra-territorial earnings for the year amounted to....	$565,514 85
Of which this company's share is.....	75,617 30
An increase over 1885 of.....	2,208 02

In the case of six companies which have not reported for the entire twelve months, the statement has been completed from the average for the months reported.

It will be noted that the number of miles of wire underground has materially increased, and we expect further large additions to the underground mileage in the current year, especially in New York, where the Subway Commission has made arrangements for the working of an underground system, which will meet the requirements of the wire companies.

The legality of the plan adopted by them has been questioned in the courts, and further legislation may be needed before the work can be completed; but, as there is a strong public desire for the burying of wires to the greatest practicable extent, the necessary legislation will probably be obtained and the work go forward. This will involve a heavy outlay by the Metropolitan Telephone and Telegraph Company, and the subject has been under careful consideration by the directors of that company and by our Mr. Davis; and they are prepared to put a

EXCHANGES.

	1883.	1884.	1885.	1886.	1887.	Decrease from 1886.	Increase over 1886.
Exchanges	725	906	722	747	736	11	....
Branch offices	345	419	481	428	446	.....	18
Miles of wire on poles	.....	.....	88,481	100,382	111,349	.....	11,017
Miles of wire on buildings	.....	.....	11,856	10,043	10,587	.....	544
Miles of wire underground	.....	.....	1,225	3,417	6,030	.....	2,613
Miles of wire submarine	.....	.....	.....	254	265	.....	11
Total miles of wire	68,571	85,896	101,592	114,046	128,231	....	14,185
Total circuits	74,484	97,422	107,440	112,067	121,260	.....	9,193
Total employes	3,716	4,762	5,168	5,438	5,843	.....	405
Total subscribers	97,728	123,625	134,847	137,750	147,068	.....	9,318

EXTRA-TERRITORIAL LINES.

	Jan. 1, 1883.	Jan. 1, 1884.	Jan. 1, 1885.	Jan. 1, 1886.	Jan. 1, 1887.	Increase during 1886.
Number of lines	247	598	826	897	911	14
Miles of pole lines	6,154	20,592	25,766	30,697	31,143	446
Miles of wire	13,653	29,359	35,631	41,745	43,767	2,022

UNDERGROUND WIRES.

	Jan. 1, 1886. Miles.	Jan. 1, 1887. Miles.	Increase over 1886. Miles.
Albany	.....	1	1
Boston	289	347	58
Brooklyn	134	1,233	1,099
Chicago	760	1,462	702
Detroit	.....	82	82
Louisville	.....	9	6
Milwaukee	1	1	.....
New York	627	627	.....
Pittsburgh	614	966	352
Washington	992	1,302	310
	3,417	6,030	2,613

INSTRUMENTS.

	Dec. 20, 1882.	Dec. 20, 1883.	Dec. 20, 1884.	Dec. 20, 1885.	Dec. 20, 1886.	Increase during the Year.
In the hands of licensees, under rental	237,726	298,580	325,574	330,040	353,518	23,478

large part of their wires into subway conduits as soon as the obstacles referred to are removed.

Following the policy outlined in the last report in respect to licensed companies operating in territory of little value where it was found difficult to build up a profitable business, we have modified our contract relations with several of such companies, and have negotiations in progress with several more, which will, in our judgment, place these companies upon a sound footing, will promote friendly relations, and will serve to encourage the proper development of the business.

The concessions made involve yielding a certain share of the profits immediately accruing to these companies, but will, we believe, in the long run, prove of mutual advantage to ourselves and the companies interested.

Terminal facilities have finally been secured, within a few months, in Philadelphia, for the long line service, and arrangements completed for giving facilities for conversation to New York and other important points. Several private lines are already under contract between Philadelphia and New York, and we shall this year be able to go far in ascertaining the value of this class of business.

The delay in getting facilities granted in Philadelphia has prevented us from determining this question in a practical manner; but we consider it of sufficient importance to connect Boston with New York to warrant building that line without waiting for the commercial result in the Philadelphia and New York line, and are taking steps to complete it during the present year,

The treasurer's statement shows :

Gross earnings for the year from all sources.....		$3,097,000 91
Expenses.....		1,149,717 79
Net earnings.....		$1,947,283 12
Miscellaneous credits.....		26,067 64
Total.....		$1,973,350 76
Regular dividends paid..	$1,176,252 00	
Extra dividends paid..	392,084 00	
Total.....	$1,568,336 00	
Reserve for depreciation of instruments.	117,754 59	
		1,686,090 59
Balance to surplus account..		$ 287,260 17
Total surplus.....		1,491,380 18

The Canadian company continues to do extremely well; it has increased its subscribers during the year from 9,614 to 11,600, and its net earnings from $158,000 to $190,565.83; and although the Blake transmitter patent, as well as the Bell patents, has been declared void, the business of the company seems to be on a most healthy and prosperous footing.

We have to report progress in our lawsuits as follows:

In the suit of New Orleans against the National Improved Telephone Company, an associate of the Pan-Electric Company, an injunction was granted by Judges Pardee and Billings, on the 31st of May, after an argument lasting about twenty days. It will be remembered that this case, besides all the old matters, contained everything that had been introduced before the Secretary of the Interior regarding the alleged frauds.

The court stated in its opinion that while the various decisions that had previously been rendered would be sufficient to entitle the complainants to a decree, still, owing to the importance of the case, they preferred to take it up *de novo*. The opinion was a very strong one, and sustained the company in all its claims.

Suit was soon after begun against the Pan-Electric Companies in Texas, and an injunction issued on November 5.

We have also secured decrees against the Pan-Electric Company operating at Baltimore, and the McDonough Telephone and Telegraph Company, the Globe Telephone Company, the Long-Distance Telephone Company, and the Wallace Electric Telephone Manufacturing Company in New York.

A suit against the American Cushman Telephone Company was begun in Chicago, on July 20, and testimony is now being taken.

The Dolbear case was finally reached in the United States Supreme Court in January, and by agreement of counsel and consent of the court, the Drawbaugh case and the Molecular, Clay and Overland cases were advanced, and the whole argued as one cause. The arguments continued from January 24 to February 8. The court has reserved its decision.

FIG. 4.—HESS GUEST CALL AND FIRE ALARM ONLY.

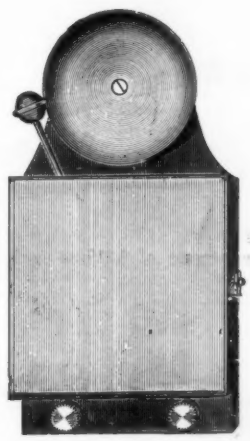


FIG. 3.—BELL.

In the case of the United States against The American Bell Telephone Company, begun at Columbus on March 23, 1886, a motion was filed on May 3 to set aside the marshal's return, and on May 3 a plea to the jurisdiction was entered. These were argued from the 20th to the 23d of September before Judges Jackson and Sage, Judge Welker sitting with them, and on November 11 the court rendered its decision in our favor; and the bill was finally dismissed on December 7.

The Government took no appeal, but on January 13 filed a bill in the District of Massachusetts, substantially the same as that which has been dismissed in Ohio.

The operation of the Indiana law regulating rates has proved to be as mischievous to the public as was predicted. It of course at once stopped absolutely any extension of business, and checked that steady improvement which is constantly going on towards greater efficiency and convenience to the public in the conduct of the business. The service was so crippled that strong popular feeling showed itself, urging the repeal of the law. The bill for its repeal passed the House by a very large majority, and went to its third reading in the Senate, when the political complications arising out of the questions relating to the lieutenant-governorship arrested all business during the remainder of the term of the session.

Bills for the regulation of telephone rates have during the past winter been introduced into a number of the State Legislatures. In these cases where final action has been had, the measures have been rejected, and a disposition seems to be generally felt against imposing restrictions which it is not customary to place upon other branches of business.

At the present time, when it is becoming necessary for all the large telephohe companies to incur heavy outlays for underground wire work, it certainly seems that they should be relieved from the danger of having measures adopted which would prevent all profitable development of the business.

Our company and our licensees are proposing to make large outlays to give increased facilities for telephone connection, which there would be no temptation to provide if there were much probability that the States could and would place restrictions upon prices for that which we shall have to sell.

By Act of 1886, Chapter 270, a modification was made in the law under which this company is taxed in Massachusetts, the result of which has been to increase our tax very considerably; that laid on the 1st of May, 1886, amounts to $74,846.98.

The patent division continues its work of digesting American and British patents relating to electrical subjects, including not only inventions claimed but inventions described in specifications unclaimed.

FIG. 5 —PUSH BUTTON FOR GUESTS' ROOM

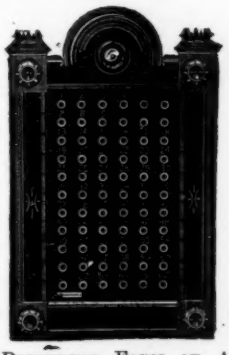


FIG. 6.—DIFFERENT FORM OF ANNUNCIATOR.

It has also prepared during the year and reported on a large number of subjects submitted by the officers of the company.

The electrical division has been much occupied in experimental work at the instance of counsel engaged in our various litigations.

It has also begun and made considerable progress in an extended series of experiments on pole lines and on mixed cables and pole lines for calculating the dimensions of pole wires and cables forming the alternate links in any chain of telephonic communication.

The mechanical department has given much time to studying long-distance transmitters, and to the general question of transmitters of the granular carbon type.

It has also devised a suitable form of instrument for use in mines, and a form for the use of divers.

The books of the company have been examined three times during the year, and the report of the auditing committee is appended.

The business of 1887 has opened well, and the directors look with confidence for a prosperous year.

For the Directors,
W. H. FORBES,
President.

....The telegraph line built by the French in Tonquin having recently failed to work, it was found, upon investigation, that the chief of one of the native villages had appropriated a quantity of the wire to his own use, and replaced it with a cord of vegetable fiber. He was very much surprised when informed of the damage he had done, and had no idea but that he had made "a fair exchange and no robbery."

TELEGRAPHIC

.... The Atlas Engineering Works, Södertelje, Sweden, have just completed, for the Portuguese Government, a number of six carriages constituting a complete field telegraph train. One carriage makes the telegraph station, with convenient accommodation for dispatching messages; the next is a van for poles—it is able to hold 150 somewhat slender poles; the third carriage is intended to carry a supply of wire—11,000 meters four-twisted wire in eleven rolls; next comes a carriage with all the requisite tools, and the last two are for various stores. The carriages are made partly of ash and partly of Swedish pine; all the wood-work is varnished. The wheels are of steel, and are made under Wersén's patent.

.... About the middle of next month the B. & O. Railroad and Telegraph companies will take possession of their new quarters, corner of Canal street and Broadway in this city. The ground floors will be devoted to the railroad and express interests, while the second, third and fourth floors will be occupied by the executive departments. The entire fifth floor has been transformed into an immense telegraph operating room. All the wires have been strung, the tables placed, and all that is now required to make the equipments complete is the force of 200 operators. The room is 136 feet long and 58 feet wide. Sextette tables to accommodate 310 sets of instruments, a gigantic switchboard holding 550 wires, an aerial railway for the distribution of messages, and 14,000 cells of battery combine to make this one of the largest and best equipped telegraph operating rooms in the world.

.... As mentioned in our issue of April 9th the Phelps Induction Telegraph Company and the Railway Telegraph and Telephone Company have been consolidated under the name of the Consolidated Railway Telegraph Company, with a capital stock of $2,500,000. The trustees are Eugene Crowell, Charles A. Cheever, Thomas A. Edison, Louis J. Phelps, Ezra T. Gililand, Charles E. Crowell, Charles H. Haskins, William M. Safford, Felix Gottschalk, Cornelius Van Brunt, William H. Stevenson, and John C. Tomlinson. The Railway Telegraph Company and the International Railway Telegraph Company have been consolidated under the name of the Consolidated International Railway Telegraph Company, with a capital stock of $500,000, with the same trustees as the other consolidated company, except Messrs. Haskins, Safford, Gottschalk and Stevenson, and the addition of Henry D. Hall, Eugene G. Blackford, and John D. Cheever.

.... A private exhibition was given in Washington recently, to a few invited persons, of a type-writer machine calculated to transmit writing by telegraph, and by means of a duplicate machine at the other end of the wire the same would be transcribed at one and the same time what the sender was operating, the shifting of the carriage of the type-writers at the end of a line being automatic. A public test of the machine will be made, within two months' time, between Washington and Philadelphia. If the new invention proves a success, the plan contemplated is to sell the machines to subscribers, who, by the system of a central exchange, the same as prevails with the telephone, can call up another subscriber, and, whether the person addressed be at his machine or not, a message can be sent him, which he can read at his machine when he returns. It is calculated, also, that no third person can tap the wires, or take a message which is being sent. The inventor is an old Philadelphia telegraph operator named McLaughlin. Patents have been taken out in this and a number of foreign countries.

Telephones for the Orient.

Some months ago Chang Yen Woon, the Chinese Minister at Washington, came to New York to see the sights. Among other things new to him was the long distance telephone. A wire from the office of the Postal Telegraph Company was connected with the Chinese legation at Washington. The minister was highly pleased at being given the opportunity of talking with his attaches 240 miles away. He thought the telephone would be a great improvement on the primitive and bungling telegraph system now in vogue in China.

A number of Philadelphia capitalists, who were present at the telephone test, acted upon the suggestion of the minister, and quietly went to work forming a syndicate, the object of which was to be the introduction of the telephone and Morse system of telegraphy and the extension of railroads in the Flowery Kingdom and Japan.

After a great deal of quiet diplomatic work the syndicate obtained permission to take a force of experts to China in order to show by way of experiment what could be done.

The first party, consisting of Frank P. Roe, electrical engineer; William Biddle, Maurice Hennessy, and James Drummond, linemen, departed on March 19 on the steamship Hampshire for Shanghai, via the Suez Canal. They took with them considerable freight, in the shape of electrical devices.

The second party left one week ago for San Francisco, where they will take a steamship on the 20th inst. They will arrive at Shanghai at about the same time as the Hampshire. This party is composed of a few of the members of the Philadelphia syndicate whose names could not be learned, as the matter has been kept profoundly secret, and their identity is not disclosed. With them is Mr. E. T. Barberie, a New York electrical engineer, who has general supervision of the experimental expedition.

Mr. Barberie was for many years a member of the Western Union cable staff, and later the chief electrician of John W. Mackay's telegraph ventures. He is confident of his ability to demonstrate to the Chinese and Japanese Governments that the interests he represents are essential to the growth and welfare of the industries of those countries, and expects to obtain concessions from them covering from twenty to thirty years.

Wires will be strung between the principal cities in Japan and China, and the experiments begun with the least possible delay. Should they prove satisfactory to the Governments, Mr. Barberie will return in the fall for the purpose of purchasing material and organizing a staff of engineers, electricians and mechanics, who will at once begin the work of erecting lines, building railroads or whatever else is wanted. A large amount of Philadelphia money is said to be behind the scheme.

Cheap Fuel for Electric Lighting.

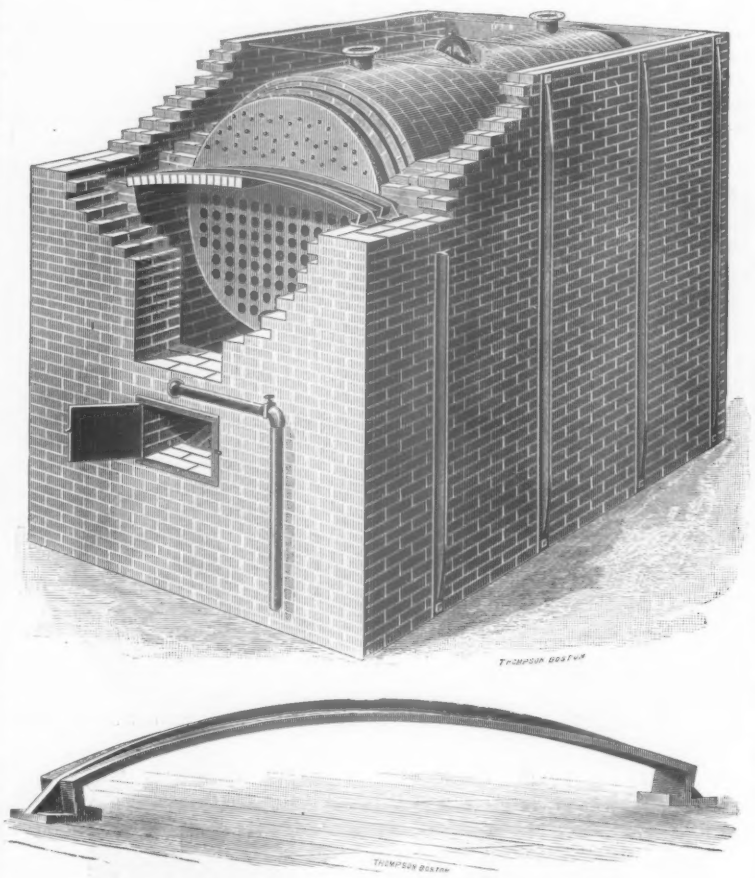
In no other business does the cost of fuel used enter to a greater extent in the cost of operation than in that of supplying electric light and power.

The problem of the distribution of electric current for light is that of producing cheaply and selling power. The last thought of, but by no means the least important part of an electric plant, is the boiler, furnace and accessories. The experience of the past seven years has shown that those stations in which the power plant has received that intelligent supervision that the electrical plants have always received, has distanced all others in point of dividends. Fully as much heating effect can be obtained from screenings or waste coal, costing at the mines a mere nominal sum, and at centers of consumption, on an average, about one-half the price of Cumberland coal. The difficulty in burning this cheap fuel is overcome by the Jarvis furnace.

Fuel, especially wet slack, sawdust, etc., when first added to a fire, generates a large amount of gas, which escapes unconsumed through the stack, because lowered below the igniting point, by cold air admitted to aid combustion. If, however, intensely hot air be admitted, this will not happen, and the gas will be consumed, producing an intensely hot flame.

This result is accomplished by the Jarvis furnace by admitting air by small flues in the front, and, while passing through intensely heated ducts, becomes so hot that when mixed with the gases from the grate, complete combustion is obtained.

The method of setting boilers illustrated in Fig. 2, in which arched covering bars, shown in Fig. 3, are used, is durable and substantial. All appliances, including pumps, injectors, Sheffield or National grate bars and heaters are supplied by the company in their complete equipment of power plants. Illustrations of these are given. The Jarvis Engineering Company, of Boston, has recently opened a New York office at 109 Liberty Street.



FIGS. 2 AND 3.—ARCHED COVERING BARS.

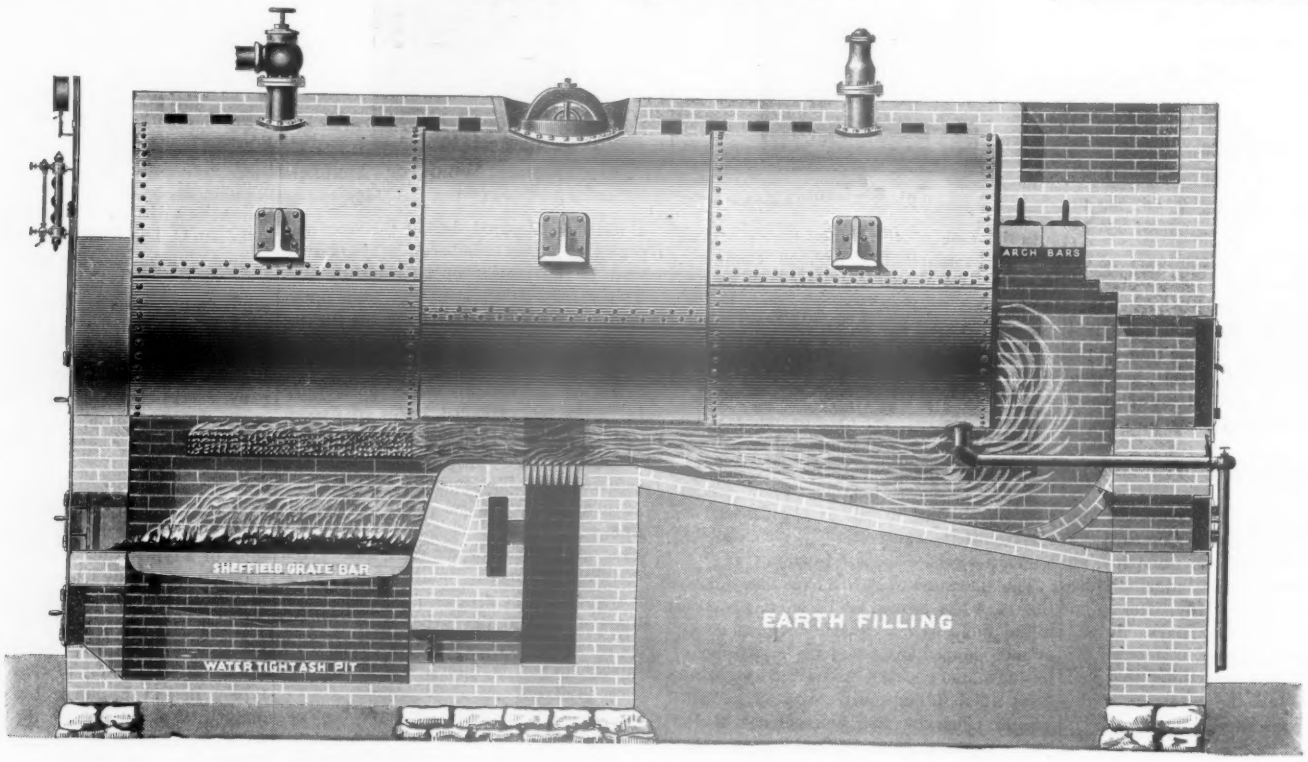


FIG. 5.—THE JARVIS PATENT HOT AIR FURNACE FOR SETTING STEAM BOILERS.

PERSONAL NOTES.

Dr. Geo. H. Benjamin is engaged in several large engineering schemes—a work that will take him away from New York a portion of his time the next year or two. The doctor was formerly connected with the Holly system of water works, superintending a number of extension installations.

Mr. Sam Bryan, general manager of the Chesapeake and Potomac Telephone Company, stole a few hours from his busy Washington life and paid New York a flying visit last week. His territory is important and admirably managed, and notwithstanding the many attempts made by infringers to gain a foothold in his domain, he has constantly advanced the legitimate telephone interests, to the detriment of all stock-scheming influences.

Mr. C. D. Crandall, of Kansas City, Mo., secretary and treasurer of the Missouri and Kansas Telephone Company, has been a consistent believer in the telephone and its future, and now has the satisfaction of seeing his interests in it growing in value. A flattering offer to come to New York with a large electrical establishment was not sufficient to win him from the present position he so acceptably fills.

Captain Willard L. Candee, Co. B, 23d Regiment, Brooklyn, is the third senior captain in the regiment, commands the best drilled company and is a very popular officer. The fascinations of military life have not prevented a successful commercial one, and besides being treasurer of the Okonite Insulated Wire Company, Captain Candee is director in several large corporations, among them a prominent street car company in the city of Brooklyn.

Col. J. J. Dickey and Mr. Flemon Drake, of Omaha, have been Boston and New York visitors the past week, fixing up Western telephone and telegraph matters, of which they are active and reliable representatives. No visitors are more welcome at the offices of the American Bell Telephone Company and the general offices of the Western Union Telegraph Company than these two gentlemen, and few come so thoroughly informed on all practical matters relating to these branches of electric work. They report a general advance in all branches of electric work in their section, and have recently organized the Midland Electric Company, at Omaha, to handle general electrical supplies.

Lighting Railway Trains.

The Connecticut River Railroad is arranging for lighting its cars with the electric light. The current is to be supplied from storage batteries beneath the floor of the cars. It is the intention of the company to have a dynamo in the baggage car, belted to the trucks, and in this way obtain power for runing the dynamo, when the train is at a certain speed, and lighting the lamps in the cars direct. An automatic appliance is to cut out the dynamo and switch in the batteries when the speed of the train slackens, so that the light can always be relied upon, whether the train is in motion or stopping at a station. It is thought that the arrangements can be made so perfect as to keep the light steady and strong at all times.

Conductivity of Metallic Filings.

A glass tube containing filings is placed in a voltaic circuit; its conductivity is found to be nearly nil; but on passing through the filings the induced currents from an induction coil, the fillings acquire a certain degree of conductivity which they afterwards preserve, but which disappears little by little in time. The value of the conductivity depends essentially on the chance arrangement of the metallic particles.

Electro-Calorimeter.

The electro-calorimeter is constructed with two spiral Breguet springs placed one above the other, the one with the silver inside, the other with the silver outside; they are fixed by their opposite ends, A B^1, to terminals which bring the current, joined together at their free ends, B A^1, and at about the middle C of the height of the apparatus by a small rod placed in their common axis; the expansion of the two springs tends to rotate in the same direction a metallic pointer or a mirror fixed to the springs at C. The arrangement, insulated by two disks of ebonite, is enclosed in a brass tube pierced wi h a number of holes; this tube is surrounded by a double case of large size, containing water, and intended to cut off all radiated heat from outside objects. The movements of C are observed by Poggendorff's method.

The author, A. Roiti, gives the mathematical proof that the rise of temperature of the springs is proportional to the quantities of heat they receive, contrary to the opinion expressed by Lenz and Poggendorff. This theoretical proof is supported by the results of experiments in which the electro-calorimeter was compared with an air thermometer. The results agreed very closely; and it is worthy of note that the electro-calorimeter gave results just as accurate for alternate currents as for continuous currents. The instrument was of great use in determining the efficiency of the secondary generators of Gaulard and Gibbs.

Disposing of the Dead.

The body of Robert S. Boyd, says a Buffalo exchange, was sent to Boston in an air-tight metallic casket in charge of Mr. J. A. Cummings, a cousin of Boyd. The following card was received from the two Boston gentlemen, who were so tireless in their efforts to discover the body of their unfortunate friend:

In behalf of the relatives and many friends of the late Robert S. Boyd, we desire to return our sincere thanks to those citizens of Buffalo, with the officers and members of the different departments, the press, and all others, who have rendered such prompt, cheerful, and valuable service in the recovery of the body and in establishing the identity of our lamented friend and associate.

W. A. Hovey,
Thomas B. Doolittle.

Imitation Rosewood. — Boil one-half pound of logwood in three pints of water till it is of a very dark red; add one-half ounce of salt of tartar. Stain the work with the liquor while it is boiling hot, giving three coats. Then, with a painter's graining brush, form streaks with the following solution: Boil one-half pound of logwood chips in two quarts of water; add one ounce of pearlash, and apply hot.

The Accumulators of Farbaky and Schenek.

The experiments were made on a set of 56 cells, each with seven positive and eight negative plates, 55 by 30 cm. square. When the 56 cells were discharged at the rate of 159.5 amperes for 6½ hours, the E.M.F. fell from 110.4 to 101.5 volts, or 8.07 per cent.; and when at the rate of 160.4 amperes for the same time, the E.M.F. fell from 110.1 to 102 volts, or 7.35 per cent. On a third occasion the discharge current was 155.2 amperes, and the fall in the E.M.F. at the end of 6½ hours from 100 to 99.5 volts, or 8.71 per cent. Hence for a mean discharge of 1,000 ampere hours, the loss of potential may be taken at 7.8 per cent.

Subsequently twenty-six of the cells were charged with 1119.21 ampere hours, or 65,090 watt hours, the charge lasting 10½ hours; they were then discharged during 6½ hours and gave 1026.95 ampere hours, or 57237.68 watt hours; the percentage efficiency was, therefore,

For quantity of electricity - 91.75 per cent.
For electrical work, - - 78.71 "

A subsequent experiment gave 90.9 per cent. and 78 5 per cent., respectively. The mean difference of potential of a charged cell was found 2.08 volts, and the internal resistance below one-thousandth of an ohm. Mechanically, the cells gave very good results, being solidly built up, and the oxidizable material not showing any tendency to fall out.

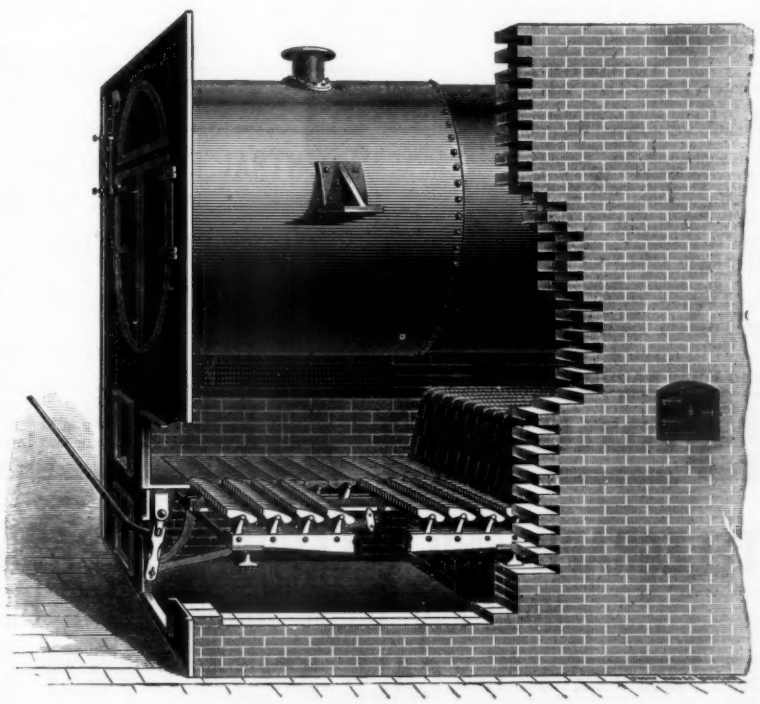


Fig. 4.—Showing National Rocking Grate Bar.

A New Telephone Company.

Articles have been filed in the County Clerk's office of Gloucester county, incorporating the New Jersey Southern Telephone Company, with a capital stock of $250,000, under letters granted to Julius Emmer. The company has secured the right of way in the seven counties south of Mercer county. The officers are as follows: President, C. W. Starr, Woodbury; Secretary, H. C. Pondenslager, Paulsboro; Treasurer, W. H. Levermore, Woodbury; Directors, W. N. Newton, James E. Highley, G. H. Barber, Hon Joseph R. Roe, J. M. Henderson, T. Earl Budd, all of Woodbury; Solicitor, Robert S. Clymer.

Col. J. N. Keller, of Boston, who made a snug sum out of the telephone business in the West—made it by hard work and keen foresight—has fitted in with Boston culture and a big salary as general manager of the New England Telephone and Telegraph Company, with a readiness that proves his remarkable versatility. Yet there are occasions when there comes to him, as to every man who ever was accustomed to it, a desire for the freedom of the plains, the wide-extending breathing spaces of the great untamed West.

— The Schaefer Electric Light Company has a number of its lamps on exhibition at the Worcester (Mass.) Industrial Exposition.

— Mrs. Herbert, the wife of a switchman at Joliet, Ill., has not spoken a word nor opened her eyes in three months. Fluid food is given her. The woman is reduced to a mere skeleton. The physicians agree that she is afflicted with catelepsy. The doctors will let the case run along till warm weather, when electrical apparatus will be used to revive the sleeper.

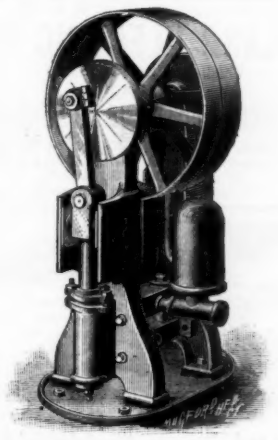


Fig. 5.—Shepard's Improved Power Pump.

— The "Empire State Electric Company" of Georgia has been organized with Mr. P. Burbank as electric expert. They propose putting in operation at once a large electric light and power plant, which will use the Thomson-Houston system.

— The Utica Gas Light Company and the Central New York Electric Light and Power Company have been consolidated, forming a new organization to be known as the Utica Electric and Gas Company. The capital stock is $300,000.

— The underground conduit for electric light wires between Fairmount and Columbia avenues, Philadelphia, has been finished, and the lamps were lighted the first of the week for the first time.

— Hartford, Conn., is considerably exercised over the efforts of the Light and Power Company of that city to get a charter for city lighting. The new company would be a competitor of the one at present lighting the city with the Thomson-Houston system.

— The Metropolitan Street Railway Company of Atlanta, Ga., are about closing negotiations with the Van Depoele Manufacturing Company, of Chicago, for a plant in Atlanta, which will require a 250 horse power generator and 18 ten horse power moters to begin with. It is said the plant will be in active operation by June 1.

Electric Light News

— A Brush electric light plant is to be put in at Talladega, Fla.

— The gas company of Houston, Texas, is putting in an electric light station.

— The Fort Wayne Jenney Electric Light Company has contracted for a plant at Huntsville, Fla.

— The city of Petersburgh, Va., has contracted with the Thomson-Houston Electric Light Company to light the city for five years.

— The Badger Illuminating Company, of Milwaukee, is enlarging its plant and expects to have 140 arc lights in use within thirty days.

— The Empire State Electric Lighting Company has been organized at Atlanta, to operate the Thomson-Houston system of electric lighting.

— The St. Augustine Improvement Company, St. Augustine, Fla., has contracted to erect a $40,000 building for the St. Augustine Gas and Electric Light Company.

— The Winston, N. C., Electric Light and Power Company has been organized with a capital of $30,000. Mr. D. H. Starbuck is president, and D. P. Most, secretary and treasurer.

— The Brush Company furnishes all the arc lamps, sixty in number, for the Madison Square Garden, where the Barnum-Forepaugh combination has been delighting thousands for weeks past.

—Thomas Parkes, Rufus H. Rose, Julius Sax, Walter McComb and J. B. Morgan have chartered the Southern Car Heating and Illuminating Company, Nashville, to build machines to light and heat railroad cars.

— The Henry Electric Railway of Kansas City, Mo., is still in the experimental stage, but is promised to be ready for public use by May 1st. This line extends out to Fifth street, the system comprising an overhead wire.

— George F Card, George McLaughlin, John A. Gano, H. K. Lindsey, Thomas F. Corry, and George W. Howell, have incorporated the George F. Card Manufacturing Company, of Covington, Ky., capital stock $10,000, to manufacture and sell electrical machinery. The manufacture of an electric brake will be part of the new company's business.

— The new electric light company at Worcester, Mass., is to have a capital of $10,000, all of which has been taken. The plant will be put in by the Thomson-Houston Company, which holds 10 per cent. of the stock, and guarantees six per cent. to the stockholders for two years. It is the intention to erect a building in the yard of the works of C. D. Morse, and to secure the necessary power from his engine for a time. Operations will be begun at once. The company will have the town contract for lighting the streets and has calls for lights from other parties.

— Everybody ought to know that the beautiful star now adorning the western sky in the early evening is the planet Venus, the twin sister of the earth. That everybody does not possess this interesting bit of information is shown by the fact that several persons have inquired of the *Sun* whether the star in question is not an electric light sent up in a balloon by the ingenious Mr. Edison. It is more beautiful than any electric light, and, if any one can look at this magnificently brilliant world hanging there a hundred million miles away in the golden chains of the sun, without feeling the sublimity as well as the beauty of the spectacle, he may be sure he has made no mistake in not devoting himself to astronomy.—*N. Y. Sun.*

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 12, 1887.

360,842 Electrical apparatus for separating metallic particles from paper pulp; Chas. H. Atkins, Boston, Mass.

360,844 Telegraphy; William T. Barnard, Baltimore, Md., assignor to himself, Francois Van Ryselberghe, Brussels, Belgium, and Charles Selden, Baltimore, Md.

360,852 and 360,853 Apparatus for separating metals from ores or alloys; Henry R. Cassel, New York, N. Y., assignor to the Cassel Gold Extracting Company, Limited, Glasgow, Scotland.

360,862 System of indicating time by electric lights; Patrick B. Delany, New York, N. Y.

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360,980 Hydrometer alarm; Thomas P. Whittier, East Saginaw, Mich.

360,986 Telegraphy; 360,987, Telegraphy; 360,988, Multiple telegraph system; Alfred M. A. Beale, New York, N. Y.

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361,089 Automatic car brake; Charles Selden St. Louis, Mo.

361,090 Railroad brake; Charles Selden, St. Louis, Mo.

361,115 Electric motor; William Baxter, Jr., Baltimore County, Md., assignor to the Baxter Electric Manufacturing and Motor Company.

361,116 Horizontal governor for electric motors: and 361,117, Journal bearing for electric motors; William Baxter, Jr., Baltimore County, Md., assignor to the Baxter Electric Manufacturing and Motor Company.

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